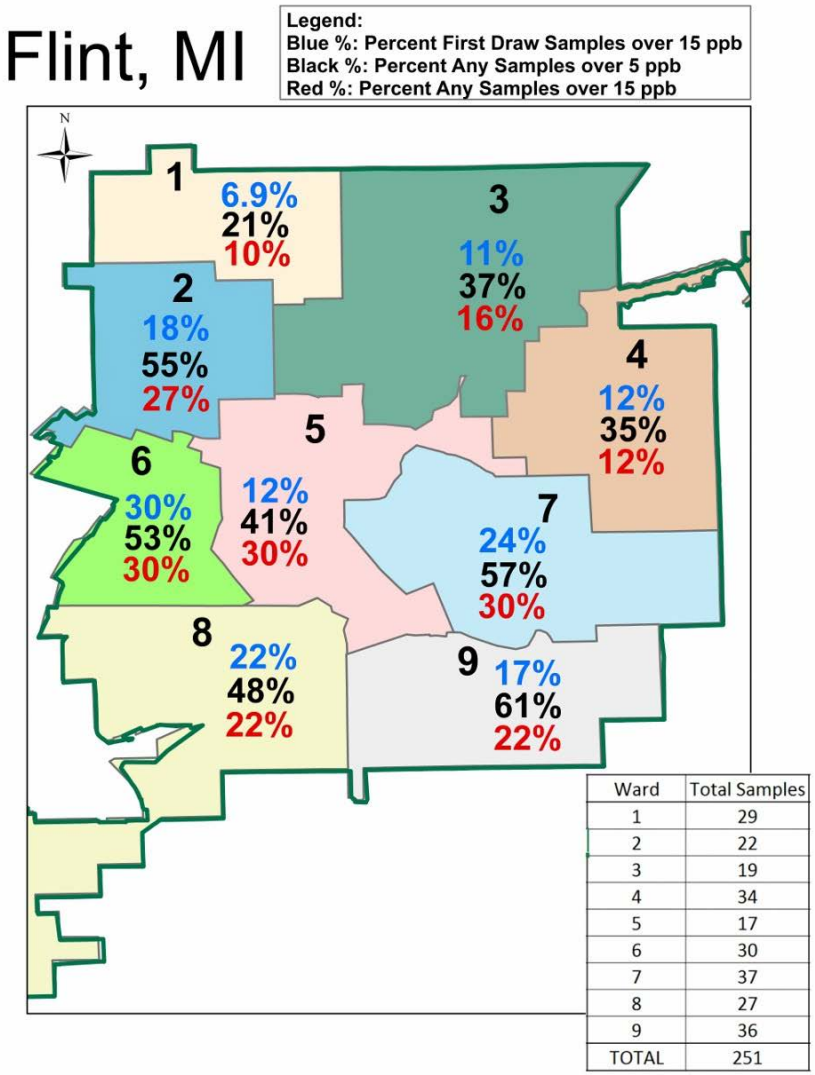
Note major chemistry changes from Detroit water. Flint water would be predicted to be very, very high in plumbosolvency, even without testing. Yet the state said they needed to collect 2 years of data as "required" by the LCR before deciding if treatment is needed, because it is a "new" water system.

Table 1. Water quality parameters for drinking water supplied in Flint, MI before and after the April 2014 switch

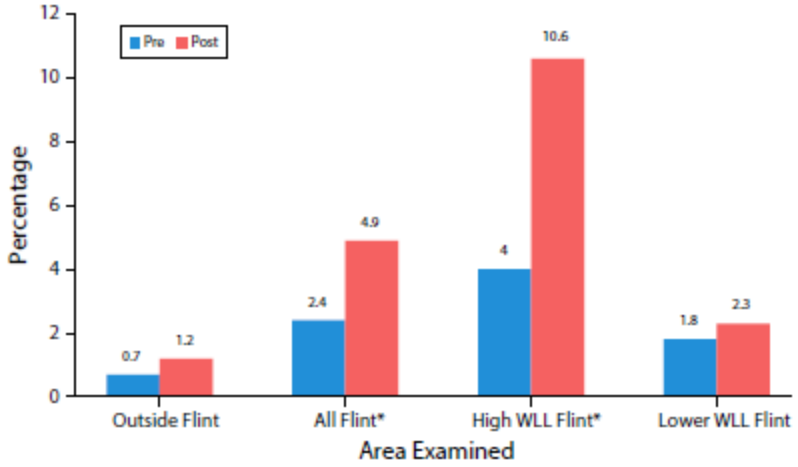
Parameter	Before[1]	After[2]
pH	7.38	7.61
Hardness (mg/L as $CaCO_3$)	101	183
Alkalinity (mg/L as $CaCO_3$)	78	77
Chloride (mg/L)	**11.4**	**92**
Sulfate (mg/L)	25.2	41
CSMR[3]	0.45	**1.6**
Inhibitor (mg/L as P)	0.35	**NONE**
Larson Ratio[4]	0.5	**2.3**

[1]Source: City of Flint Monthly Operation Report, June 2015. Available from www.cityofflint.com



Ward	Total Samples
1	29
2	22
3	19
4	34
5	17
6	30
7	37
8	27
9	36
TOTAL	251

We identified Flint wards with high WLLs with water lead sampling maps.[38] Wards 5, 6, and 7 had the highest WLLs; in each ward, more than 25% of samples had a WLL higher than 15 ppb. We theorized that children living in this combination of wards would have the highest incidence of EBLLs (referred to as “high WLL Flint”; the remainder of Flint was referred to as “lower WLL Flint”).



Note. WLL = water lead level.
*$P < .05$.

FIGURE 1—Comparison of Elevated Blood Lead Level Percentage, Before (Pre) and After (Post) Water Source Change From Detroit-Supplied Lake Huron Water to the Flint River: Flint, MI, 2013 and 2015

TABLE 2—Ward-Based Comparison of Observed and Predicted Water Lead Level Percentages, Before (Pre) and After (Post) Water Source Change From Detroit-Supplied Lake Huron Water to the Flint River: Flint, MI, 2013 and 2015

Ward	WLL % >15 ppb	Pre EBLL%	Post EBLL%	Predicted Post BLL[a]	Change in Predicted BLL From Pre to Post, µg/dL
1	10	0.0	2.8	1.4	−0.10
2	25	0.0	1.4	0.7	0.19
3	18	1.0	4.5	2.9	0.05
4	6	3.1	1.7	2.4	−0.15
5[b]	32	4.9	15.7	10.3	0.51
6[b]	28	2.2	9.3	5.5	0.27
7[b]	28	5.4	5.9	5.7	-0.26
8	20	2.7	1.4	2.0	0.01
9	20	3.4	1.6	2.5	−0.43

Note. BLL = blood lead level; EBLL = elevated blood lead level; WLL = water lead level.
[a]Ordinary Kriging geostatistical analysis.
[b]Indicates wards defined as high WLL risk in this study.

Timeline of Major Events

- Flint received finished water from Detroit for about 50 years
- Detroit added orthophosphate in 1996
- 2011/2012 meetings to discuss option of changing water source from Detroit to a pipeline from Lake Huron (KWA)
- 2013
  - City council votes to move to KWA for long-term solution (2.5 years away)
  - Detroit notifies Flint their contract will end in 2014 without extension
  - Consulting firm hired to prepare Flint plant for *Flint River water* until KWA is available
- 2014
  - New appointed emergency manager refuses to renew Detroit contract
  - State Department of Environmental Quality approves change to Flint River water
  - Flint River water feeds system starting in April
  - Major taste and odor complaints start in June
  - *E coli* found, boil water orders in August
  - October, General Motors plant stops using Flint water: “too corrosive”

Timeline of Major Events (cont'd)

- 2015
  - Enhanced chlorination causes TTHM SDWA
  - University of Michigan (Flint) finds high lead in campus water
  - High Pb found in water at a house in LCR monitoring
  - Consultant hired, new manager refuses reconnection to Detroit
  - DEQ says all treatment proper for LCR
  - Lead poisoned children documented at house with high Pb
  - EPA Region 5 investigates
  - Leaked memo reveals major high DW lead problems found
  - August: State invalidates 2 high Pb samples, says Flint meets Action Level, using preflushing, narrow-mouth bottle, protocol
  - September: Virginia Tech volunteers sample 300+ homes, find widespread Pb problem
  - Pediatric EBLL studies show large increases since water change
  - October, Flint reconnects to Detroit water, supplemental orthophosphate dose added at USEPA recommendaton